Introduction

Science Scope provides lists of skills, topics, and concepts that are part of most science curricula. It can be used:

As a checklist.

This allows the student to use a wide variety of materials to learn about science instead of a program designed by only one company for use in kindergarten through high school. Teachers and parents can also be sure a depth of understanding is achieved, rather than simply exposure to a topic. Older students can use this book to help them recognize what they should understand and retain (checking off items themselves) whether using a text book or several books and resources.

As an overview of the progression of a topic from simple concepts to the more complicated.

Even if a topic is not introduced until a student is eleven or twelve, for example, it may be helpful to introduce it using ideas from the easier level. This guide includes material used in high school courses for the college-bound student, which may prove too complex for some students. In that case, teachers and parents have the option of taking the student as far as he is able in any topic, while making certain that basic concepts are understood.

As a reference for age-level expectations.

Find out how much can be expected at any age. Keep children challenged, but not beyond their ability to meet that challenge. Topics are divided according to the following key:

Primary	Ages 4 - 8	Grades Pre K - 3
Intermediate	Ages 9 - 11	Grades 4 - 6
Junior High	Ages 12 - 14	Grades 7 - 8
High School	Ages 15 - 18	Grades 9 - 12

The age ranges are provided as a guide, not as a requirement for completing, or even introducing, topics at that age.

TEACHING SCIENCE

How do scientists come up with a concept to pass on?

First, someone asks a question. Wanting to understand why things happen as they do leads to a search for answers. The search leads to observations, experiments, and the organization of all the collected information in order to come up with a logical conclusion. When new information is discovered, the conclusion must be looked at again. If the new knowledge gives support, fine, but if not, what looked like an answer must be discarded or modified. That means scientific ideas may change. The changing attitudes and practices in medicine throughout history illustrate that science is a process.

Searching for answers may be done fairly informally. But, at some point, all the observations must be organized in such a way that the conclusions drawn can be tested by someone else with the same result. This is called the "scientific method." A scientific "law" is the conclusion or generalization that represents all the known facts. It is the law that changes with new findings. Children must learn to use the scientific method, not just define it.

WHERE TO START

1. **Choose a goal. What understanding do you want to develop?**

2. **Choose one or more activities that will allow students to use some of the skills listed in *Scientific Skills*.**

3. **Encourage discovery by asking questions rather than offering explanations. Let students look for the answers. This also encourages logical thinking.**

How many (legs) does it have? *(Instead of "A bird has two legs.")*

What do you think will happen if _________?

Why do you think _________?

What could you change so that _____ would (happen)?

How would (our life, its life) be different if . . .
("...there were no gravity." "...it didn't have any predators.")

Activities should give the students the opportunity to do at least some of the following:

Describe or explain.

Recall
  ∉ Information already gained that may apply.
  ∉ Conditions of an experiment from the previous day.
  ∉ The order in which events occurred: What happened first? Next?

Speculate or predict.

Collect and organize his own data and draw his own conclusions.

Ask questions that can lead to further study.

4 Guide students toward discovery.

Suggest questions, and sometimes offer information that students could not discover (in the situation) in order to guide students toward discovering some central theme or point. This process should include helping students decide which factors are relevant (useful), and which are irrelevant.

Skills that involve reasoning include: inferring, predicting, controlling variables, interpreting data, and/or formulating a hypothesis.

5 Teach the student about variables and the need for a control in experimentation.

Introduce the idea of variables and the need for a control when questioning leads to conducting an experiment in order to find answers, or to test ideas. This can be introduced by questioning. For example, if trying to determine the cause in a change in the weight of a hamster, ask "If we give him different food and different exercise equipment, how will we know which caused any changes we see?" Lead the student toward the understanding that only one condition can be changed at a time.

6 Teach students not to jump to conclusions.

When you want to help students realize that they must not jump to conclusions based on one experiment, perform one experiment several times to see if the results are the same, or conduct several different experiments to prove one point.

Follow up

Students can easily get lost in the process and never really understand the point (your objective). Therefore, it is essential that you conduct some kind of follow-up. Here are a few types of follow-up to choose from, or you may think of other ideas:

Discussion
Discuss the experiment and results (review and summarize) and what was learned in order to prevent mistakes from being repeated, or to re-emphasize the point.

Application
Have students draw on what they've learned in order to deal with a current situation. For example, let a young child check the weather and then choose his own clothing after a lesson on how weather determines how people dress.

Drill
Construct and administer some sort of test (written or oral) or contest.